



life.augmented

# Protections and Filters application book for : Automotive cameras



Power & Discrete Sub-Group

APMS PRODUCT GROUP



All products presented are automotive grade and PPAP capable

**ESDCAN03-2BM3Y**  
Datasheet

Automotive dual-line TVS in DFN for CAN bus

**Features**

- AEC-Q101 qualified
- Bidirectional dual-line ESD and EOS protection
- Trigger voltage,  $V_{TRIG}$  min = 28 V and low clamping factor  $V_{CL} / V_{TRIG}$
- QFN-3L 1.1 x 1.0 x 0.55 package also called DFN1110
- Max pulse current to 3.3 A (8/20  $\mu$ s)
- Low leakage current
- ECOPACK2 ROHS compliant component

**Complies with the following standards**

- J-STD-020 MSL level 1 and UL94, V0
- IPC7531 footprint and JEDEC registered package
- ISO 16750-2 (Jump start and reversed battery tests)
- ISO 10605 / IEC 61000-4-2- C = 150 pF, R = 330  $\Omega$ , exceeds level 4:
  - $\pm 15$  kV (contact discharge)
  - $\pm 30$  kV (air discharge)
- ISO 10605 - C = 330 pF, R = 2 k $\Omega$ :
  - $\pm 30$  kV (contact and air discharge)
- ISO 10605 - C = 330 pF, R = 330  $\Omega$ :
  - $\pm 12$  kV (contact discharge)
  - $\pm 30$  kV (air discharge)
- ISO 7637-3:
  - Pulse 3a/3b: +/-150 V
  - Pulse 2a: +/- 85 V

Product status link  
ESDCAN03-2BM3Y

Product summary  
Order code ESDCAN03-2BM3Y

Part numbers for automotive grade protection & Filters devices end with a “Y”

They have datasheets with relevant information for automotive applications

# Protection & filter solutions for automotive cameras

Ethernet	
Connector side	<a href="#">ESD1001-1BM2Y(*)</a>
PHY-side	<a href="#">HSP051-2W3Y</a>

Long-reach LVDS
<a href="#">ECMFY series</a>
<a href="#">HSP061-4M10Y</a>
<a href="#">ESDAXLC6-1BT2Y</a>

Short-reach LVDS
<a href="#">ECMFY series</a>
<a href="#">HSP051-2W3Y</a>
<a href="#">HSP061-4M10Y</a>

Antenna
<a href="#">ESDAXLC6-1BT2Y</a>

Parallel video lines
<a href="#">EMIF06-1005MX12Y</a>
<a href="#">USBLC6-xSC6Y</a>

MOSFET protection
<a href="#">ESDA051-1JY</a>
<a href="#">ESDA14V2LY</a>
<a href="#">SM4T18(C)AY</a>

Analog video output
<a href="#">ESDALC5-1BT2Y</a>
<a href="#">ESDAVLC8-1BT2Y</a>

Power over coax (PoC)
<a href="#">SM6F18AY</a>

CAN & FlexRay
<a href="#">ESDCAN series</a>



PSE
<a href="#">ESDA051-1JY</a>
<a href="#">SM6F18AY</a>

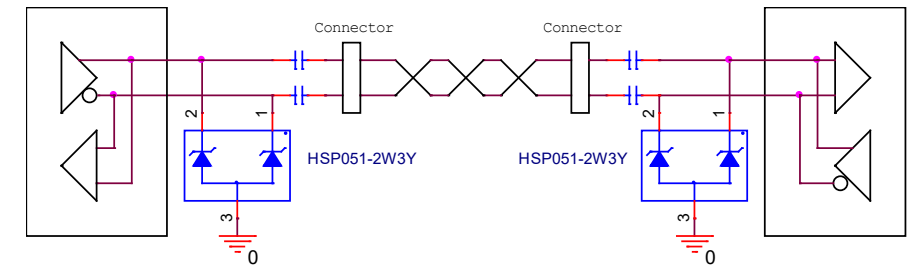
I <sup>2</sup> C
<a href="#">USBLC6-2SC6Y</a>

VBat
<a href="#">SMA6TY series</a>

# Long-reach LVDS (SERDES) FPD-link, GMSL, APIX, MIPI A-PHY

Standalone ESD protection or integrated solution with both ESD protection and common mode noise filter in same package

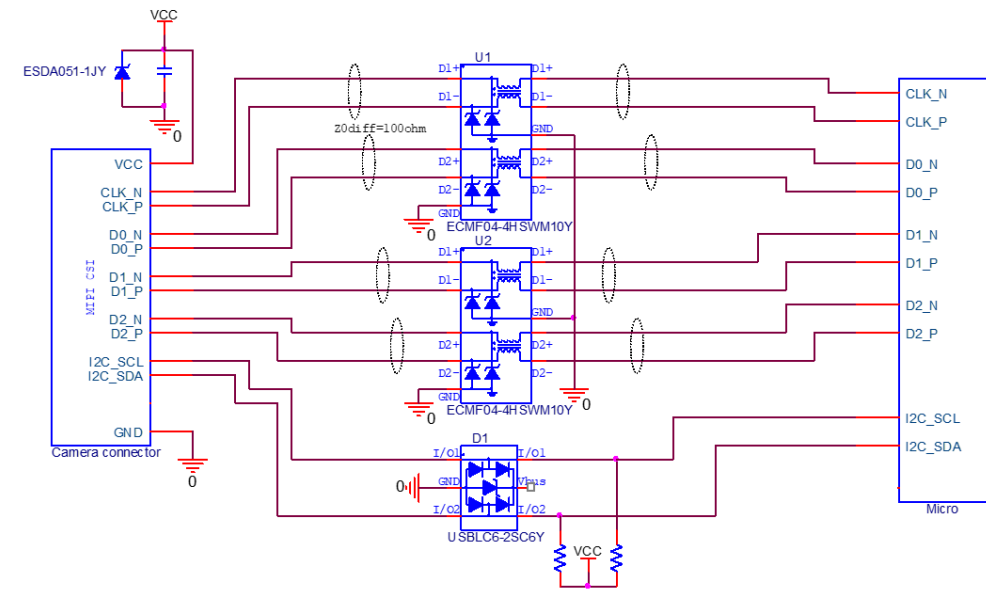
Long-reach LVDS needs	Product key parameters	ST solutions
Voltage $\leq 2.5$ V	$V_{RM} \geq 3$ V (HSP061-4M10Y/ESDXLC6-1BT2Y) $V_{RM} \geq 5$ V (HSP051-2W3Y)	<u>HSP061-4M10Y</u> <u>HSP051-2W3Y</u> <u>ESDAXLC6-1BT2Y</u> <u>ECMFY series</u>
Positive signal	Unidirectional	
Data rate: up to 16 Gbps (worst case: 8 GBaud/lane MIPI A-PHY G3 P1 NRZ)	Bandwidth up to 12 GHz (ESDAXLC6-1BT2Y)	
Design flexibility	Dual line, unidirectional	<u>HSP051-2W3Y</u>
Design flexibility	Single line, bidirectional	<u>ESDAXLC6-1BT2Y</u>
Avoid to disturb antennas	CMF rejection $\geq -15$ dB (600 MHz to 8 GHz) Various rejection shapes	<u>ECMFY series</u>
IEC 61000-4-2 level 4 ISO 10605 (C=150 pF, R = 330 $\Omega$ ) 8 kV contact/15 kV air	Contact discharge: $\geq 8$ kV Air discharge: $\geq 15$ kV	



# Short-reach LVDS MIPI CSI

Standalone ESD protection or integrated solution with both ESD protection and common mode noise filter in same package

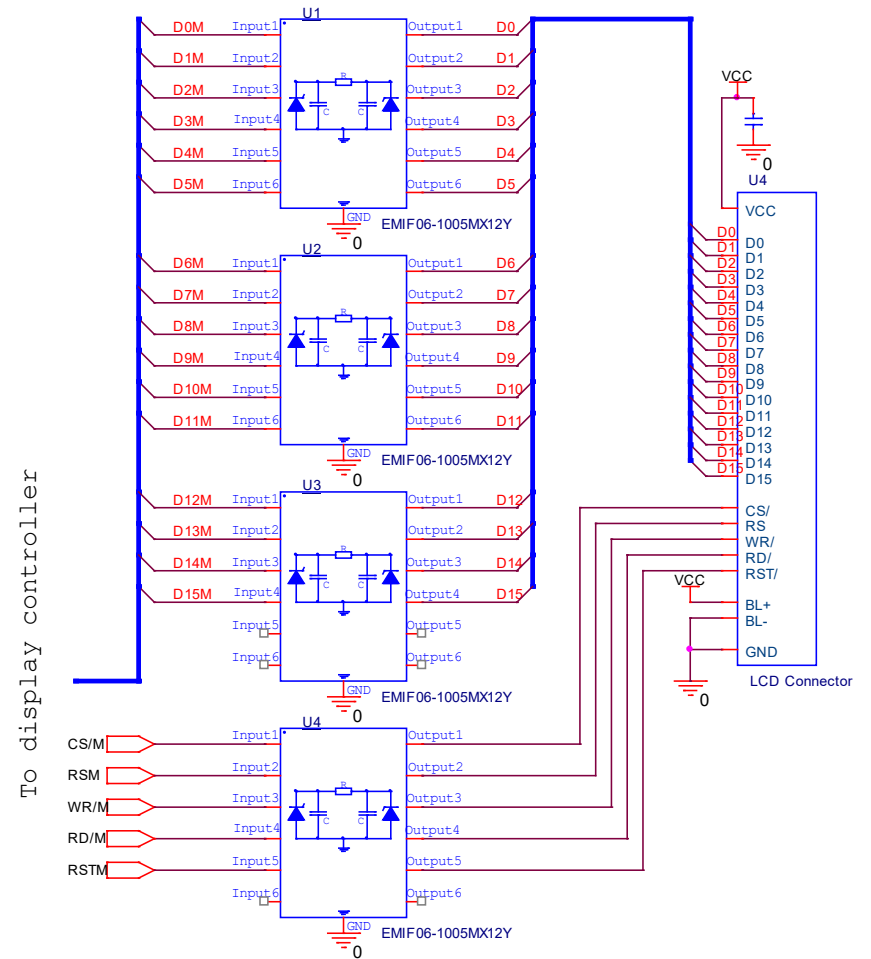
Short-reach LVDS needs	Product key parameters	ST solutions
Voltage $\leq 2.5$ V	$V_{RM} \geq 3$ V (HSP061-4M10Y/ESDXLC6-1BT2Y) $V_{RM} \geq 5$ V (HSP051-2W3Y)	<b>HSP061-4M10Y</b> <b>HSP051-2W3Y</b> <b>ESDAXLC6-1BT2Y</b> <b>ECMFY series</b>
Positive signal	Unidirectional	
Data rate: up to 9 Gbps (CSI-2 over D-PHY 3.0)	Bandwidth up to 12 GHz (ESDAXLC6-1BT2Y)	
Design flexibility	Dual line, unidirectional	<b>HSP051-2W3Y</b>
Design flexibility	Single line, bidirectional	<b>ESDAXLC6-1BT2Y</b>
Avoid to disturb antennas	CMF rejection $\geq -15$ dB (600 MHz to 8 GHz) Various rejection shapes	<b>ECMFY series</b>
IEC 61000-4-2 level 4 ISO 10605 (C=150 pF, R = 330 $\Omega$ ) 8 kV contact/15 kV air	Contact discharge: $\geq 8$ kV Air discharge: $\geq 15$ kV	



# Parallel video lines

Standalone ESD protection or integrated solution with both ESD protection and EMI filter in same package

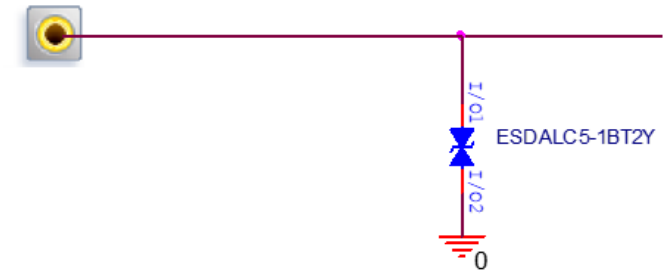
Parallel video line needs	Product key parameters	ST solutions
Voltage 1.8 V or 3.3 V	$V_{RM} \geq 3\text{ V}$ (EMIF06-1005MX12Y) $V_{RM} \geq 5.25\text{ V}$ (USBLC6-xSC6Y)	<u>USBLC6-4SC6Y</u> <u>USBLC6-2SC6Y</u> <u>EMIF06-1005MX12Y</u>
Positive signal	Unidirectional	
Pixel clock frequency up to 200 MHz	Bandwidth: <ul style="list-style-type: none"> <li>120 MHz (EMIF06-1005MX12Y)</li> <li>Up to 3 GHz (USBLC6-xSC6Y)</li> </ul>	
Design flexibility	Dual line, unidirectional	<u>USBLC6-2SC6Y</u>
Noise filtering Avoid to disturb antennas	Attenuation $\geq -15\text{dB}$ (250 MHz to 6 GHz)	<u>EMIF06-1005MX12Y</u>
IEC 61000-4-2 level 4 ISO 10605 (C=150 pF, R = 330 $\Omega$ ) 8 kV contact/15 kV air	Contact discharge: $\geq 15\text{ kV}$ Air discharge: $\geq 15\text{ kV}$	



# Analog video output/CVBS

CVBS amplifier output is ESD protected according to ISO 10605 (C=150 pF, R=330  $\Omega$ )

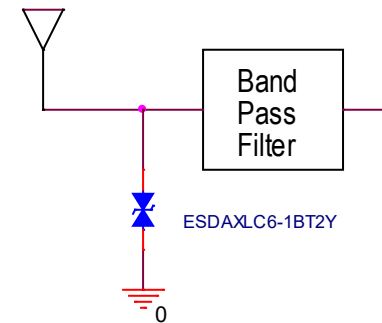
CVBS needs	Product key parameters	ST solutions
-0.3 V $\leq$ voltage $\leq$ 1 V	$V_{RM} \geq 3$ V	<u><a href="#">ESDALC5-1BT2Y</a></u> <u><a href="#">ESDAVLC8-1BT2Y</a></u>
1 data line	Single-line	
Pixel clock frequency up to 10 MHz	Bandwidth: <ul style="list-style-type: none"><li>• 210 MHz (ESDALC5-1BT2Y)</li><li>• 1.2 GHz (ESDAVLC8-1BT2Y)</li></ul>	
IEC 61000-4-2 level 4 ISO 10605 (C=150 pF, R = 330 $\Omega$ ) 8 kV contact/15 kV air	Contact discharge: $\geq 15$ kV Air discharge: $\geq 15$ kV	



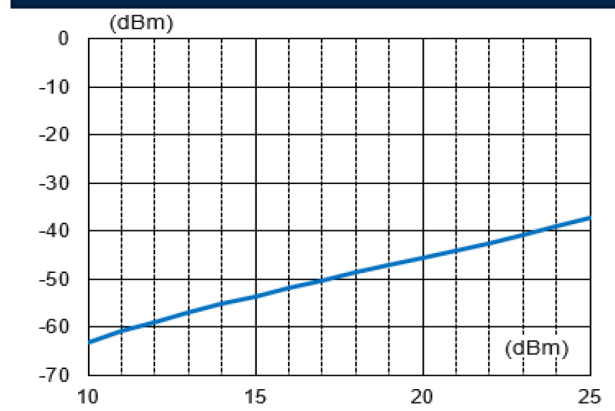
# Antennas

Antennas are ESD protected according to ISO 10605 (C=150 pF, R=330 Ω)  
 Very low harmonics ensure no disturbance in application

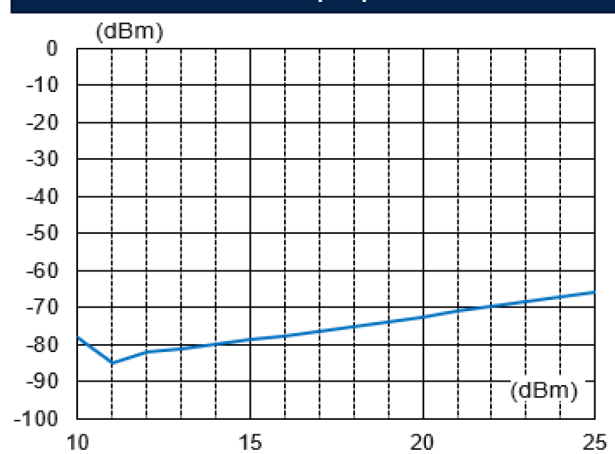
Wi-Fi antenna needs	Key product parameters	ST solutions
RF power = 20dBm ( $V_{PEAK} = 3.2\text{ V}$ with $50\Omega$ load)	$V_{BR} \geq 6\text{ V}$	<b><u>ESDAXLC6-1BT2Y</u></b>
Alternative signal	Bidirectional device	
f = 2.4 GHz f = 5.0 GHz	Extra low capacitance ( $\leq 0.5\text{ pF}$ ) Bandwidth = 12 GHz Typical IL @ 2.4 GHz = 0.2 dB	
Very low harmonic generation	H3 = -45 dBm at 20 dBm power; f = 2.4GHz	
IEC 61000-4-2 level 4 ISO 10605 (C=150 pF, R = 330 Ω) 8 kV contact/15 kV air	Contact discharge: 16 kV Air discharge: 30 kV	



H3 harmonic versus input power at 2400 MHz



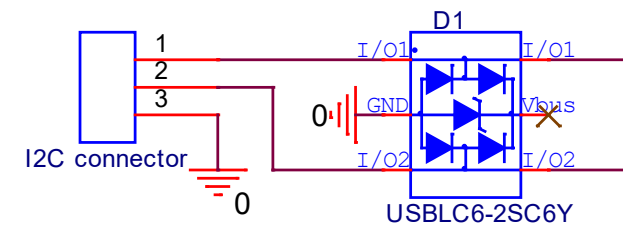
H2 harmonic versus input power at 2400 MHz





I<sup>2</sup>C socket is ESD protected according to ISO 10605 (C=150 pF, R=330 Ω) with one single device.

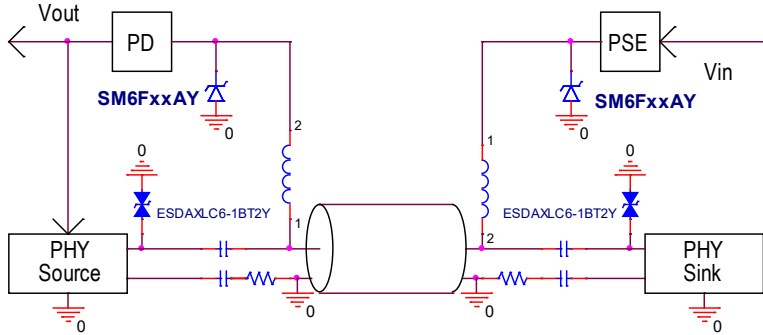
I <sup>2</sup> C needs	Product key parameters	ST solutions
Line voltage range: 0 to 5 V	$V_{RM} \geq 5.25V$	<b>USBLC6-2SC6Y</b>
Positive signal	Unidirectional	
Data rate: 3.4 Mbps – Maximum frequency: 20 MHz	Bandwidth: 3 GHz	
IEC 61000-4-2 level 4 ISO 10605 (C=150 pF, R = 330 Ω) 8 kV contact/15 kV air	Contact discharge: $\geq 15$ kV Air discharge: $\geq 25$ kV	



# Power Over Coax (PoC)

Small and flat 600W TVS compliant with all ISO standards

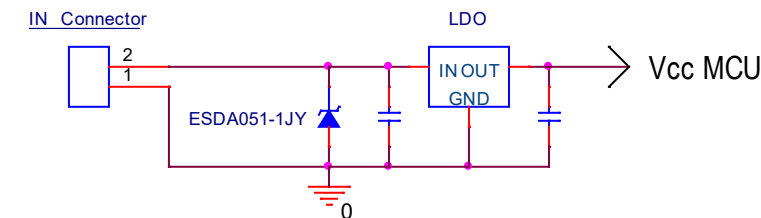
Power over coax (PoC) needs	Product key parameters	ST solutions
Voltage $\leq 13$ V	$V_{RM} \geq 13$ V	<b>SM6F13AY</b>
Positive signal	Unidirectional	
ISO 16750-2 overvoltage test required/Short-to-Vbat <ul style="list-style-type: none"> <li>18 V <math>\pm 0.2</math> V applied for 60 min for 12 V systems</li> <li>36 V <math>\pm 0.2</math> V applied for 60 min for 24 V systems</li> </ul>	<ul style="list-style-type: none"> <li><math>V_{BR} \geq 20</math> V for 12 V systems</li> <li><math>V_{BR} \geq 36.7</math> V for 24 V systems</li> </ul>	<b>SM6F18AY</b> (for 12 V systems) <b>SM6F33AY</b> (for 24 V systems)
ISO 16750-2: reversed voltage test required <ul style="list-style-type: none"> <li>-14 V <math>\pm 0.2</math> V applied for 60 s for 12 V systems</li> <li>-28 V <math>\pm 0.2</math> V applied for 60 s for 24 V systems</li> </ul> jump start test required <ul style="list-style-type: none"> <li>24 V <math>\pm 0.2</math> V applied for 60 s for 12 V systems</li> </ul>	Bidirectional devices needed  12 V systems <ul style="list-style-type: none"> <li><math>V_{BR} \geq 26.7</math> V</li> </ul> 24 V systems (incl. overvoltage test) <ul style="list-style-type: none"> <li><math>V_{BR} \geq 37.1</math> V</li> </ul>	<b>SMA6T28CAY</b> (for 12 V systems) <b>SMA6T39CAY</b> (for 24 V systems)
Low speed signal	No capacitance constraints	
ISO7637-2 <ul style="list-style-type: none"> <li>Pulse1: VS = -150 V</li> <li>Pulse 2a: VS = +112 V</li> <li>Pulse 3a: VS = -220 V</li> <li>Pulse 3b: VS = +150 V</li> </ul>	PASS	
ISO 10605 (C=330 pF, R = 330 $\Omega$ ) $\geq 15$ kV	Contact discharge: $\geq 30$ kV Air discharge: $\geq 30$ kV	



# PSE/Power control input

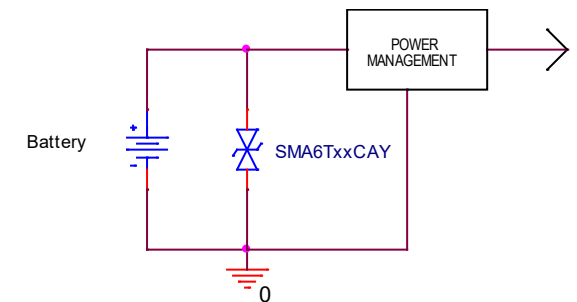
## Small and flat 600W TVS compliant with all ISO standards

PSE/Power control input needs	Product key parameters	ST solutions
Voltage 5 V or 13 V	$V_{RM} = 5 \text{ V}$ (ESDA051-1JY) $V_{RM} = 13 \text{ V}$ (SM6F13AY)	<b>ESDA051-1JY</b> <b>SM6F13AY</b>
Positive signal	Unidirectional	
ISO 16750-2 overvoltage test required/Short-to-Vbat <ul style="list-style-type: none"> <li>18 V <math>\pm</math>0.2 V applied for 60 min for 12 V systems</li> <li>36 V <math>\pm</math>0.2 V applied for 60 min for 24 V systems</li> </ul>	<ul style="list-style-type: none"> <li><math>V_{BR} \geq 20 \text{ V}</math> for 12 V systems</li> <li><math>V_{BR} \geq 36.7 \text{ V}</math> for 24 V systems</li> </ul>	<b>SM6F18AY</b> (for 12 V systems) <b>SM6F33AY</b> (for 24 V systems)
ISO 16750-2: reversed voltage test required <ul style="list-style-type: none"> <li>-14 V <math>\pm</math>0.2 V applied for 60 s for 12 V systems</li> <li>-28 V <math>\pm</math>0.2 V applied for 60 s for 24 V systems</li> </ul> jump start test required <ul style="list-style-type: none"> <li>24 V <math>\pm</math>0.2 V applied for 60 s for 12 V systems</li> </ul>	Bidirectional devices needed  12 V systems <ul style="list-style-type: none"> <li><math>V_{BR} \geq 26.7 \text{ V}</math></li> </ul> 24 V systems (incl. overvoltage test) <ul style="list-style-type: none"> <li><math>V_{BR} \geq 37.1 \text{ V}</math></li> </ul>	<b>SMA6T28CAY</b> (for 12 V systems) <b>SMA6T39CAY</b> (for 24 V systems)
Low speed signal	No capacitance constraints	
ISO7637-2 <ul style="list-style-type: none"> <li>Pulse1: VS = -150 V</li> <li>Pulse 2a: VS = +112 V</li> <li>Pulse 3a: VS = -220 V</li> <li>Pulse 3b: VS = +150 V</li> </ul>	PASS	
ISO 10605 (C = 330 pF, R = 330 $\Omega$ ) $\geq 15 \text{ kV}$	Contact discharge: $\geq 30 \text{ kV}$ Air discharge: $\geq 30 \text{ kV}$	



## 600W TVS in small SMA compliant with all ISO standards

V <sub>BAT</sub> output needs	Product key parameters	ST solutions
ISO 16750-2: <ul style="list-style-type: none"> <li>overvoltage test required               <ul style="list-style-type: none"> <li>18 V ±0.2 V applied for 60 min for 12 V systems</li> <li>36 V ±0.2 V applied for 60 min for 24 V systems</li> </ul> </li> <li>reversed voltage test required               <ul style="list-style-type: none"> <li>-14 V ±0.2 V applied for 60 s for 12 V systems</li> <li>-28 V ±0.2 V applied for 60 s for 24 V systems</li> </ul> </li> <li>jump start test required               <ul style="list-style-type: none"> <li>24 V ±0.2 V applied for 60 s for 12 V systems</li> </ul> </li> </ul>	Bidirectional devices needed 12 V systems <ul style="list-style-type: none"> <li>V<sub>BR</sub> ≥ 26.7 V</li> </ul> 24 V systems (incl. overvoltage test) <ul style="list-style-type: none"> <li>V<sub>BR</sub> ≥ 37.1 V</li> </ul>	<u><a href="#">SMA6T28CAY</a></u> (for 12 V systems) <u><a href="#">SMA6T39CAY</a></u> (for 24 V systems)
ISO 16750-2: <ul style="list-style-type: none"> <li>Centralized load dump suppression               <ul style="list-style-type: none"> <li>U<sub>S*</sub> = 35 V ±0.2 V for 12 V systems</li> <li>U<sub>S*</sub> specified by OEM (typical value 58 V ±0.2 V)</li> </ul> </li> </ul>	12 V systems <ul style="list-style-type: none"> <li>V<sub>BR</sub> ≥ 34.2 V</li> </ul> 24 V systems (incl. overvoltage test) <ul style="list-style-type: none"> <li>V<sub>BR</sub> ≥ U<sub>S*</sub>. If U<sub>S*</sub> = 58 V, V<sub>BR</sub> ≥ 64.6 V</li> </ul>	<u><a href="#">SMA6T36CAY</a></u> (for 12V systems) <u><a href="#">SMA6T68CAY</a></u> (for 24V systems)
Low speed signal	No capacitance constraints	
ISO7637-2 <ul style="list-style-type: none"> <li>Pulse1: VS = -150 V</li> <li>Pulse 2a: VS = +112 V</li> <li>Pulse 3a: VS = -220 V</li> <li>Pulse 3b: VS = +150 V</li> </ul>	PASS	
ISO 10605 (C=330 pF, R = 330 Ω) ≥15 kV	Contact discharge: ≥ 30 kV Air discharge: ≥30 kV	

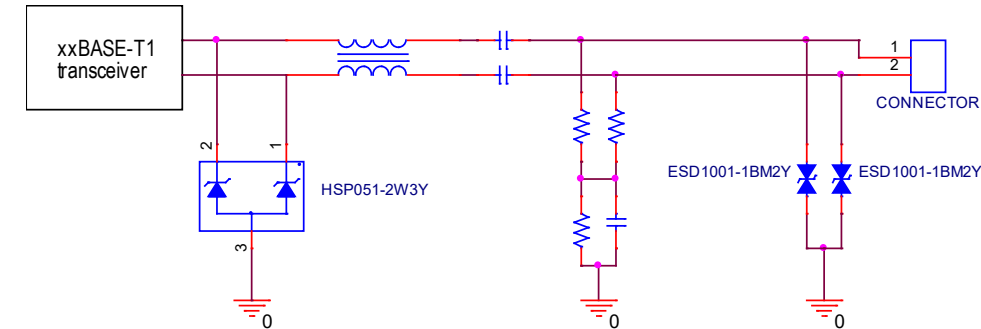


# Automotive Ethernet xxBASE-T1

## Low capacitance ESD protection in line with IEEE 1000BASE-T1

Connector side Ethernet needs	Product key parameters	ST solutions
IEEE 1000BASE-T1 requirements: <ul style="list-style-type: none"> <li>▪ Bidirectional</li> <li>▪ Operation voltage <math>\geq 24</math> V</li> <li>▪ Trigger voltage <math>\geq 100</math> V</li> <li>▪ ESD: ISO 10605 (C=150 pF, R = 330 <math>\Omega</math>) min = 15 kV contact</li> <li>▪ S parameters requirements</li> </ul>	PASS	<b>ESD1001-1BM2Y(*)</b>

PHY side Ethernet needs	Product key parameters	ST solutions
Voltage $\leq 3$ V	$V_{RM} \geq 5$ V (HSP051-2W3Y)	<b>HSP051-2W3Y</b>
Positive signal	Unidirectional	
Data rate: up to 1 Gbps (125 MBaud, PAM 3)	Bandwidth up to 3 GHz	
IEC 61000-4-2 level 4 ISO 10605 (C=150 pF, R = 330 $\Omega$ ) 8 kV contact/15 kV air	Contact discharge: $\geq 12$ kV Air discharge: $\geq 15$ kV	



## Wide CAN transceiver protection portfolio covering both 12 V and 24 V-battery systems

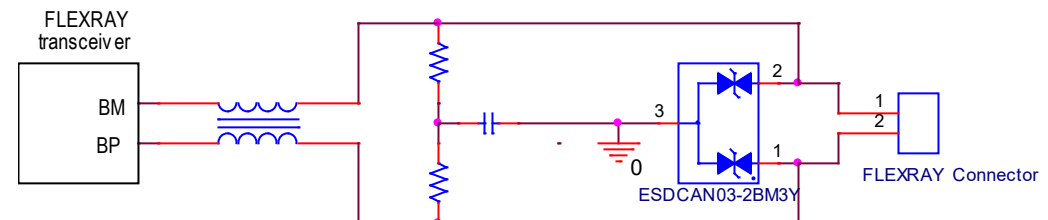
CAN needs		Product key parameters	ST solutions
ISO 16750-2: <ul style="list-style-type: none"> <li>overvoltage test required               <ul style="list-style-type: none"> <li>18 V ±0.2 V applied for 60 min for 12 V systems</li> <li>36 V ±0.2 V applied for 60 min for 24 V systems</li> </ul> </li> <li>reversed voltage test required               <ul style="list-style-type: none"> <li>-14 V ±0.2 V applied for 60 s for 12 V systems</li> <li>-28 V ±0.2 V applied for 60 s for 24 V systems</li> </ul> </li> <li>jump start test required               <ul style="list-style-type: none"> <li>24 V ±0.2 V applied for 60 s for 12 V systems</li> </ul> </li> </ul>		Bidirectional devices needed  12 V systems <ul style="list-style-type: none"> <li><math>V_{BR} \geq 26.7</math> V</li> </ul> 24 V systems (incl. overvoltage test) <ul style="list-style-type: none"> <li><math>V_{BR} \geq 37.1</math> V</li> </ul>	
Data rate <ul style="list-style-type: none"> <li>Fault tolerant CAN: 125 kbps</li> <li>High speed CAN: 1 Mbps</li> <li>CAN-FD: 5 Mbps</li> <li>CAN-FD SIC: 8 Mbps</li> <li>CAN XL: 10 Mbps</li> </ul>		Cline ≤ 3 pF for High-speed CAN, CAN-FD, CAN-FD-SIC	
Design flexibility		Dual-line in SOT23-3L	
Design flexibility		Dual-line in DFN1110 (12 V systems only)	
IEC 61000-4-2 level 4 8 kV contact/15 kV air		Contact discharge: up to 30 kV Air discharge: ≥30 kV	



[Complete BOM](#)

## Wide FlexRay transceiver protection portfolio covering 12 V and 24 V battery systems

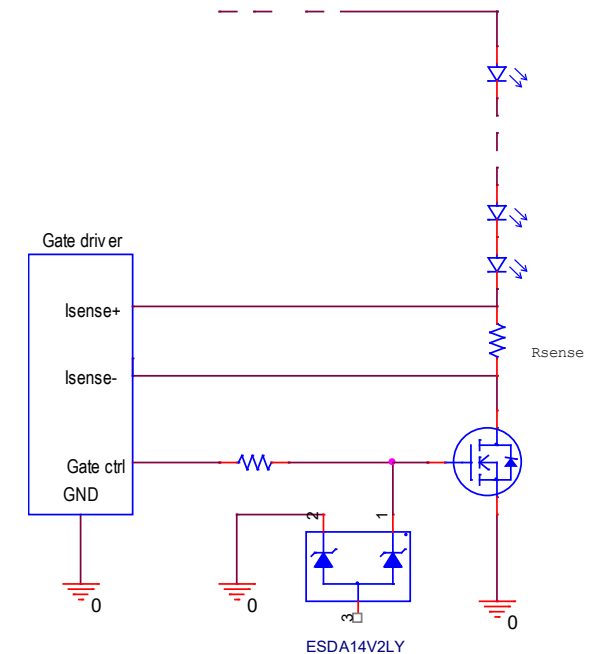
FlexRay needs	Product key parameters	ST solutions
ISO 16750-2: <ul style="list-style-type: none"> <li>overvoltage test required               <ul style="list-style-type: none"> <li>18 V <math>\pm</math>0.2 V applied for 60 min for 12 V systems</li> <li>36 V <math>\pm</math>0.2 V applied for 60 min for 24 V systems</li> </ul> </li> <li>reversed voltage test required               <ul style="list-style-type: none"> <li>-14 V <math>\pm</math>0.2 V applied for 60 s for 12 V systems</li> <li>-28 V <math>\pm</math>0.2 V applied for 60 s for 24 V systems</li> </ul> </li> <li>jump start test required               <ul style="list-style-type: none"> <li>24 V <math>\pm</math>0.2 V applied for 60 s for 12 V systems</li> </ul> </li> </ul>	Bidirectional devices needed  12 V systems <ul style="list-style-type: none"> <li><math>V_{BR} \geq 26.7</math> V</li> </ul> 24 V systems (incl. overvoltage test) <ul style="list-style-type: none"> <li><math>V_{BR} \geq 37.1</math> V</li> </ul>	    <u><a href="#">ESDCAN02-2BWY</a></u> (for 12 V systems) <u><a href="#">ESDCAN03-2BWY</a></u> (for 12 V systems) <u><a href="#">ESDCAN05-2BWY</a></u> (for 24 V systems) <u><a href="#">ESDCAN03-2BM3Y</a></u> (for 12 V systems)
Data rate up to 10 Mbps	Cline $\leq$ 3 pF/Bandwidth: 1.1 GHz	
Design flexibility	Dual-line in DFN1110 (12 V systems only)	<u><a href="#">ESDCAN03-2BM3Y</a></u> (for 12 V systems)
IEC 61000-4-2 level 4 8 kV contact/15 kV air	Contact discharge: up to 30 kV Air discharge: $\geq$ 30 kV	



# MOSFET protection

Robust protection devices rated at 30 kV versus ISO 10605  
(R=330Ω, C=330 pF)

MOSFET gate needs	Product key parameters	ST solutions
- 5 V ≤ voltage ≤ 16 V	$V_{RM} = 5\text{ V}$ (ESDA051-1JY) $V_{RM} = 12\text{ V}$ (ESDA14V2LY) $V_{RM} = 15\text{ V}$ (SM4T18(C)AY)	<u>ESDA051-1JY</u> <u>ESDA14V2LY</u> <u>SM4T18(C)AY</u>
Signal direction	Unidirectional (ESDA051-1JY, ESDA14V2LY, SM4T18AY) Bidirectional (ESDA14V2LY, SM4T18CAY)	
Low speed signal	No capacitance constraints	
IEC 61000-4-2 (R=330Ω, C=150 pF) level 4 8 kV contact/15 kV air	ISO 10605 (R=330Ω, C=330 pF) Contact discharge: ≥ 30 kV Air discharge: ≥ 30 kV	





- **ADAS** Advanced driver assistance systems
- **Bird's eye, bird view** See SVM
- **CPD** Child presence detection
- **CVBS** Composite video broadcast signal
- **DOMS** Driver and occupant monitoring system
- **DMS** Driver monitoring system
- **ECU** Electronics control unit
- **IMS** Interior monitoring system
- **ISP** Image sensor processor/ processing
- **IVN** In vehicle network
- **LVDS** Low voltage differential signaling
- **NIR LED** Near infrared light emitting diode
- **OMS** Occupant monitoring system
- **POC** Power over coax
- **PSE** Power sourcing equipment (LDO, buck, DC/DC)
- **SERDES** Serializer deserializer
- **SSD** Solid-state drive
- **SVM** Surround view monitor

# Our technology starts with You



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